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ABSTRACT

This document constitutes the response of the United States to the request that members of the United Nations participating in the Conference on the Human Environment in Stockholm prepare national reports describing their environmental problems and discuss actions being taken to resolve them. In addition, members were asked to identify topics of sufficient importance to merit international attention. This report was prepared by the Departments of Agriculture; Health, Education, and Welfare; Housing and Urban Development; Interior, and the Environmental Protection Agency. (Author/CP)

U.S. National Report on the HUMAN ENVIRONMENT

". . . What is new is the fact that we now face an increasing range of problems which are central to our national well-being, but which are, by definition, global problems, or problems which can only be dealt with effectively on a global scale.

". . . Of greater import, however, is our shared and transcendent interest in the livability of our common home, the earth. To these problems, and the opportunities they present, that interest must be our guide and the guide of others. The nurturing of that interest has now become a prime task of American leadership."

President Nixon

Report to the Congress,
U.S. Foreign Policy
for the 1970's
Building for Peace
February 25, 1971

U.S. National Report on the HUMAN ENVIRONMENT

Prepared for:
United Nations Conference on Human Environment
June 1972, Stockholm, Sweden

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Preface

In 1968 the United Nations General Assembly endorsed a Swedish proposal calling for a conference on the human environment. The conference will take place in June 1972 in Stockholm, Sweden. It will focus international attention on the importance and urgency of environmental problems and will recommend actions to cope with them.

In preparation for the conference, the United Nations member countries were requested to prepare national reports describing their environmental problems and discussing actions being taken to resolve them. In addition, members were asked to identify topics of sufficient importance to merit international attention.

This document constitutes the response of the United States to that request. It was prepared by the Department of State, based on information contributed by the Departments of Agriculture; Health, Education, and Welfare; Housing and Urban Development; Interior; and the Environmental Protection Agency.

This report was transmitted to the conference Secretary-General, Maurice Strong, in April 1971.

Contents

Introduction

Despite man's efforts to reach to the stars and distant worlds in outer space, his environment today and in the foreseeable future—and perhaps forever—must continue to be defined by the natural limitations of one finite planet.

So richly endowed eons ago with the resources to provide abundant life, this planet—within the memory of living man—has been forced to endure stresses and depletions that have strained the quality of its life-support systems.

Thus, man suddenly finds himself confronted with the perplexing problems of determining how best to stem the tide of environmental decline and to preserve as much as possible the quality of life to which he has become accustomed. In a larger sense, 20th-century man has come to the realization that the dimensions of human environment include not only all ecological systems, whether natural or manmade, but also a multitude of social and cultural values—all of which react and interact between and among one another.

Man's status is measured, therefore, by the quality of the environment in which he exists. Whereas, in primitive societies, man's activities had little impact on the pristine quality of the environment, the advent of technology and larger masses of people have brought undesirable changes in that quality. Moreover, man's exploitation of his environment has also brought a degree of affluence that has drawn dangerously near to embracing a philosophy of the invincible sovereignty of man without regard for the inevitable reactions that govern all other life systems.

As the effects of environmental degradation become more and more evident on a worldwide basis, the United States finds itself in the difficult position of trying to determine reasonable social goals for environmental quality. Until fairly recently, these goals have been rather vague. The benefits of uncontaminated air, water, and soil were recognized in a general way, but we had no effective means of determining how to balance benefits from physical change against the inescapable social costs of detrimental side effects. To adequately set proper values, some means must be determined first for identifying how much degradation of environmental quality our life-support systems can safely endure. Some progress seems to be emerging in this regard, although reliable knowledge is still rather meager in many cases.

High on the list of priority issues is the need to establish land-use policies for urban and rural areas alike—not just for isolated areas of critical concern but on a global basis. For the quality of our environment—indeed of life itself—is land-dependent. No other segment of human environment deserves more grave consideration than this fragile crust of soil from which we derive our sustenance.

Although we are rapidly developing an awareness of the effects of man on the environment, little is known of the effects of the environment on man. Since man responds both mentally and physically to his environment, we need to know to what degree technological interference may impede or disrupt nature's self-regulating mechanism—or, indeed, even threaten our own welfare or survival. Furthermore, if all societies are to contribute productively to human life processes, it seems imperative that we expand our knowledge on how changing environment—and man's interactions with them—can affect human potentiality.

The goal of the United States is to adopt an environmental program that will not force us to abandon growth but to redirect it. To do so, we must balance economic development with conservation of land, water, air, and other resources in such a way as to maintain a life of dignity and social justice.

This goal will not be easy to achieve, because it implies a balancing of individual freedom versus responsibility to others. To attain this balance, difficult value decisions must be made. No one individual—and no nation—will likely escape facing up to this situation. Nothing can be gained from a posture of isolation. The task mankind faces will demand the wholehearted cooperation of both motivated citizens and motivated governments.

If the world intends to capture the full potential of goal-directed scientific and technological change, then it seems imperative that social changes must keep pace. Only in this way can the quality of human environment be maintained at a level that will allow generations yet unborn to share the resources which they rightly deserve.

Environmental Problems

HUMAN SETTLEMENTS

Impact of Urbanization

The current pattern of human settlements in the United States is largely the product of a major long-term, worldwide, socio-economic process—urbanization. This process is the centuries-old evolution in man's way of life from the rural-agricultural life pattern to the urban-industrial way of life.

The changes wrought by urbanization cover many aspects of man's life: occupation, values, habits, affluence, social structure, and—perhaps most important of all—the relocation of people from relatively simple, low-density rural living patterns to high-density, complicated urban agglomerations. In the relatively short history of the United States, urbanization has changed a nation which at birth was 95 percent rural to a country with more than 75 percent of its people living in urban areas. More than 150 metropolitan areas have populations between 100,000 and one million, two dozen metropolitan areas have a population in excess of one million, and the largest metropolitan area is well over 10 million inhabitants.

Urbanization in the United States and the resulting change to an urban nation have brought many advantages. The industrial development associated with urbanization—greater amount of capital utilized per unit of labor, the specialization and division of labor, economies of scale, improved transportation and communication, and the like—resulted in ever greater output per worker which in turn yielded higher and higher levels of material comfort. Greater affluence permitted better health and living conditions for increasing numbers, increased educational opportunities, and social and cultural advances. But the benefits of urbanization and the development and growth of very large urban areas were also accompanied by serious disadvantages and problems. Today, for many in the American city, the quality of life leaves much to be desired. And for many of the small towns and rural settlements, their viability, continued attractiveness, and very future are in serious question.

We have come in the United States to feel that we cannot expect to solve the problems of our cities unless we solve, too, the problems of towns and rural settlements. We have programs to prop

427-943 O - 71 - 2

up faltering economies in rural and sparsely populated areas and we have programs for the deepening problems of cities. But it is only recently that we have begun to realize that the two problems are very closely related. In some cases rural areas have lost the young and the enterprising to the city; in other cases migration has been the export of rural problems to the city.

Despite this urban growth, the rather stable population growth rate of about 1 percent a year gives credence to the belief that the United States is not facing an impending population explosion. However, the issue cannot be defined solely in quantitative terms. Rather, Americans have developed a new concern for the quality of life. The criteria for judging the population problem in the United States then are the kind of life its citizens can live in terms of health, education, housing, work, play, intellectual achievement, and personal freedom on one hand and resource utilization on the other. Material wealth obscures the dangers inherent in rapid growth and at the same time aggravates many of the difficulties such growth entails. All this has led many individuals to espouse various and controversial levels of "optimum population size" for the United States.

Although it is difficult to reach agreement on an optimum population size, the issue of population distribution can be readily identified. There have been vast migrations of U.S. citizens from rural areas to metropolitan centers in recent years. Practically all of this growth has occurred in suburban areas. While central cities grew only about 1 percent in the last decade, suburban population increased by 28 percent, so that today more than half the people in metropolitan areas live outside the central cities. It is probable that this fraction will continue to grow.

Assuming that the rural-to-urban movement persists, most of the U.S. population growth over the next decade will be concentrated in the 12 largest urban regions. These 12 areas will contain over 70 percent of the population but will occupy only one-tenth of the land area. The result will be further decline in the vitality of small towns and rural areas so that farm populations may decline to only 2 percent of the total population by the year 2000. If the matter does not receive attention, smaller communities will be bypassed by the economic mainstream, while the vitality of central cities declines and growth proceeds in a disorderly, congested pattern at the edge of urban areas.

Urban Congestion

Perhaps the foremost problem of American urban settlements is congestion, a situation that results in part from the short supply of good housing, ineffective land-use controls, and inadequate mass transit facilities.

Although the United States is by many standards a young country, many American cities have major structures which were constructed in the 19th century. Far-reaching changes in technology, among which are major improvements in transportation and communication as well as changes in social and cultural values and objectives, have made many commercial, industrial, and residential parts of these cities inadequate and unsatisfactory. High densities, frequently better described as overcrowded housing, are accompanied by inadequate open space and recreation areas, no parking facilities for automobiles, aging and obsolete schools, an absence of health and community facilities, and below-standard mechanical equipment in housing, both in quantity and quality. Narrow streets, which were satisfactory for horse-and-buggy days, are much less than adequate for modern life and modern standards.

The problems of American large cities are greatly complicated by internal shifts in location and changes in the pattern of activities, which have been especially significant since World War II. Peripheral or suburban residential growth, much of it unplanned and sprawling, has been enormous and has affected virtually every large city. The major transportation improvements which permitted large-scale residential development in suburban areas have also led to important commercial and industrial relocation from central city to suburbia. The central city has become more and more an area of poverty and blight. In all too many cases, these changes had either not been anticipated, or, if they had been, physical and organizational changes had not been made to accommodate the changes. Or perhaps the changes were hasty, shortsighted, or in error.

Many of the emerging problems are so different or new that they require experimentation and innovation in the search for solutions. Until recently, few of our cities possessed the overall climate or the professional leadership needed if such approaches were to be adopted.

Separate from, yet intimately related to, the physical aspects of human settlements are the socioeconomic aspects. The inner city poor and the newly arrived in-migrants are the first to feel the effects of this changed dimension of the urban environment. And there is no question but that they suffer the most. But the socioeconomic costs of poor American urban environment have wide ramifications and important impact throughout urban areas.

Because the cheapest dwelling units in American cities are located in their inner .zones, newly arrived residents, immigrants from abroad, and in-migrants from domestic rural areas are drawn to these locales. These zones are also the older and blighted areas. In decades past, many of these areas were poor and blighted, had many slum characteristics, but nevertheless incorporated a large measure of vitality and community strength. They were for many

residents "way stations," for themselves and their children, from which they launched their moves up the social and economic ladder. More recently, however, the inner vitality and strength of these inner city societal groups appear in many cases to have dropped greatly. Physical slum appearances have become more commonly associated than before with negative social attitudes, apathy, frustration, losses in motivation, and increases in crime and delinquency. This downhill socioeconomic cycle affects the physical environment adversely. In turn, it adds momentum to social degradation and alienation, each feeding on the other.

Declining Environmental Quality

The quality of urban life is increasingly affected by a multitude of environment-related factors: contaminated air, water, and food; higher noise levels; dangerous streets; crowded dwellings; uncollected garbage and rubbish; tenant and landlord irresponsibility; inaccessible community facilities; lack of recreation space and facilities; and inability to bridge the communications gap between technology and the people who benefit from it. All of these factors contribute to the problems of disadvantaged citizens in a manmade environment.

The quality of urban life also is affected by aesthetic factors. Economic pressures have forced many cities to replace historic buildings and distinctive architectures with steel- and glass-box office buildings with a dreary sameness.

Many cities have lost the spirit to attract people downtown. With the growing number of shops and other services locating in the suburbs and with crime threatening many local urban businesses, much of the vitality is missing from the central cities. Litter and waste, the by-products of affluence, continue to deface the urban landscape. In too many cities the amount of open-space parklands, which give breath and beauty to an urban environment, is inadequate to meet needs.

Inadequate Governmental Structure

Another major problem of human settlements is the limited capability of local governmental machinery to cope with national growth. In this rampant pushing out of human settlements in all directions, there has been a multiplication of governmental bodies and a fragmentation of public responsibilities that has defied a creative approach to bring order out of confusion.

Acceptable standards of community services have risen rapidly with growing affluence; the level of public facilities required to

service an increasingly congested urban society have likewise mounted. At the same time, revenue sources of city governments have become inadequate to meet the financial challenge of the urban crisis.

These and other problems have led to a growing consensus in the United States in favor of rationalizing local government and reducing fragmentation through improved metropolitan governing structures. Much thought and increasing support are also being given to the possibilities of channeling migration away from already overcrowded, large cities to smaller cities with superior, overall environment. New local government structures with wider geographic responsibilities may also be helpful in more effectively meeting the needs of towns and small rural settlements. In this process, it will be extremely important to improve the means by which citizens can make their desires known and to assure that all levels of government are responsive to the views expressed by individuals.

NATURAL RESOURCES

The United States is blessed with a wide variety of natural resources that provide the basis for its national economy. Rational management of these resources implies the use of policies that are chiefly motivated by reason. One might suppose, then, that the United States has managed its resources rationally for the better part of the Nation's existence. Occasionally, however, one of those critical points in time arrives, bringing a realization that something long taken for granted is no longer true. Thus, we are now aware of the extent to which our air and waters are polluted, our wildlife endangered by man and his works, our land scarred and being swallowed up by the demands of a burgeoning population, our mineral resources dissipated through profligate use, and the quality of life of vast numbers of people inexorably diminishing. The present challenge to the United States—and to every developed and developing nation—is to determine a more rational way of using resources so that economic growth and social progress can continue without jeopardizing the health, safety, and well-being of people or endangering the Nation's security.

Paradoxically, as a nation we must discover new reserves of natural resources, while at the same time applying more restraint in how resources are extracted and used, what price is paid for them, and what is done with the land from which they are taken. Our society now has become acutely aware of both material shortages and environmental values. In many instances, these shortages can be

projected. What they will mean in terms of impact upon the economy and upon traditional social and political values cannot readily be determined.

Water

The Nation's water resources are fundamental to the well-being of present and future generations. They represent a priceless, national asset which can and must be managed to meet all needs. If properly distributed, the total water resource would suffice to meet current and foreseeable demands. Distribution, however, is uneven among the major river basins. In some basins, the water supply is already critical; in others, it soon will be.

The western part of the United States, accounting for about 61 percent of the Nation's area, has only 38 percent of the water; the East, with 39 percent of the area, has 62 percent of the water.

Many areas in the United States are faced with near future water shortages, particularly of potable water, and by the year 2000 the number of such areas will increase significantly. Water resources studies, especially in the water-short areas of the southwest, show that major new supplies of potable water must be identified by 1980. For many of these areas, desalting or precipitation management may be an attractive means for augmenting supplies.

A 10- to 20-year lead time may be required to develop additional large-scale surface water or other alternate water sources. Planning and decisions concerning the alternate sources of supply must be made as soon as possible to provide the necessary lead time for implementation. To be considered as a viable alternative, desalting must be demonstrated as a reliable and economic technology, available when needed.

The Nation's precipitation also can be managed to meet growing water needs. Experimental and operational cloud-seeding programs are indicating potential 10- to 20-percent increases in precipitation. Two billion acre-feet of water is a reasonable estimate of the gross potential for the country. Large-scale tests and associated studies are needed to demonstrate operational feasibility, resolve complex environmental considerations, and assure the development of public acceptance of cloud seeding as a practical and economically feasible water-resource management technique.

The development of geothermal reservoirs in the western part of the United States offers great potential for new water supplies, clean energy, and minerals.

In addition to the need for on-going applied engineering research in such areas as materials, electric power, hydraulics, water quality,

etc., there is an increasing need for expanding research into new areas, such as beneficial recycling of waste waters.

Changing population patterns, economic criteria, environmental effects, and sociological influences are of increasing concern to water-resource planners and developers. Research is needed to determine how to deal with these factors while continuing to physically develop our water resources to meet current and future needs.

Research, development, and application of more efficient water-management technology in crop production can greatly improve efficiency of water use. Agriculture will continue to be the largest consumptive user of water. Yet water for allocation to domestic, industrial, and recreational use in many locations must come in part by diverting some from agriculture. Therefore, criteria and institutions for allocation of water must be reviewed and revised.

Land

As the U.S. population continues to grow, increasing demands will be made for the utilization of all public and private lands and their resources. It is estimated that 2 million acres of rural land are converted each year to nonagricultural use. Half of this is shifted to such uses as wildlife refuges, recreation areas, and parks. The other 1 million acres are converted to more intensive uses. Urban expansion consumes an estimated 420,000 acres of land each year. Open space is continuously eaten up by housing, which often provides few parks. Shopping centers, powerplants, transmission lines, and highway interchanges take over large portions of land. Airports pose similar problems on an even larger scale, attracting a vast conglomeration of light industry and housing.

Uncontrolled building and construction practices often end in severe abuse of the land and are ultimately costly to the public. The popular practice of stripping subdivisions of all cover before commencing construction destroys tree and plant cover and can trigger heavy soil runoff. Sedimentation from this runoff in urbanizing areas loads nearby streambeds and ultimately river channels. This can cause costly downstream dredging, upstream flood control, and destruction of the aesthetic quality of lakes and rivers.

Suburban development often spreads across ridges and slopes which should be left alone because of their beauty and because their trees and plant cover absorb rain and inhibit flooding. Building on steep slopes can affect soil stability, causing severe erosion which then undermines foundations. Nevertheless, few cities or counties adequately control development of flood plains, steep slopes, or land above aquifer recharge areas.

Farmland near cities is increasingly disappearing into suburban developments. Unfortunately, insufficient effort has been made to keep the most attractive rural lands near cities from being converted to urban uses.

Past practices in the use of land and development of natural resources have resulted in serious resource and environmental damage to both public and private lands. One hundred and seventeen million acres of the 175.2 million acres of public land in the 11 Western States are in a deteriorating condition; 45 million acres are severely eroded. (This public land acreage does not include the National Forests.)

There are 150 million acres of public lands in the 11 contiguous Western States where livestock grazing is important.

The intensive grazing management program begun in the early 1960's is yielding public benefits beyond the increase in livestock production. Advantages have emerged in improving watershed conditions and wildlife habitats related directly to national needs for environmental-damage correction and future recreational needs.

Living Resources

Forests are the largest self-perpetuating terrestrial ecosystem. They provide global benefits as well as local contributions to man's welfare. Forests contribute significantly to the global cycling of carbon dioxide, and they constitute the largest reservoir of organic carbon. They produce about one-half of the net photosynthesis on the earth and account for over half of all transpiration. The air-conditioning effect of a warm, moist forest is about the same as that of an ocean surface. Forests play a role in cleansing pollutants from the atmosphere and provide shade and windbreaks, shelter and food for wildlife, and a haven where man can escape from human concentrations.

Our National Forests amount to about 187 million acres. They are managed in consonance with ecological principles, on a multiple-use basis. While principal use varies among the many forest areas, generally water harvest, wildlife habitat, recreation, natural beauty, livestock grazing, and timber production are principal multiple-use objectives.

In all, the United States has about 760 million acres of forests and woodlands, of which about 510 million acres bear stands of commercial value. Timber production in 1970 amounted to about 11.1 billion board feet. It is expected to amount to 13.5 billion board feet in 1980. Increases of as much as 60 percent over the present level of production are possible.

Emerging demands for environmental quality in forests, combined with an ever-increasing demand for forest products, make traditional silvicultural practices inadequate in today's world. Traditional counterattacks on the primary forces destructive to forests (fire, insects, disease) are no longer adequate—particularly with reduction or elimination of many pesticides. Yet we have made substantial progress in the protection of our forests and in increasing their productivity. For example, during the 1940-44 period, an average of 3.3 million acres of forest area was burned each year, while during the 1965-69 period an average of 1.6 million acres burned each year.

The social and economic environments of our people depend heavily upon the success and stability of the Nation's agriculture and its associated enterprises which provide our food and fiber. In turn, the high productivity of U.S. agriculture demands wise management of its natural resources—soil, water, cultivated crops, and domestic livestock. To protect and improve these resources, Federal and State Governments and private interests are engaged in continuing, large-scale programs of management, research, and extension teaching.

The genetic capacity of crop plants and animals has been greatly increased by selective breeding and hybridization. Development of dwarf wheats responsive to fertilizer has increased yields in the United States and provided genetic material useful for yield increases in other countries. Hybrid corn and grain sorghum have substantially increased yields of these crops in comparison to open-pollinated stocks.

Of particular significance, cereal breeders in the United States, in cooperation with cereal breeders in other countries, continue to produce stocks resistant to new, virulent strains of cereal rusts as they emerge and thus help protect our own and the world's food supply.

Yield and product quality of livestock and poultry have also been continually improved, providing genetic stocks and production methods widely useful in other countries.

Both crop and livestock production in 1980 are expected to be about 25 percent more than in the 1967-69 period. Continuous application of increasingly effective research-based technology is expected to make such yield increases possible.

The land resources of the Nation can make an important contribution in achieving national goals and objectives for outdoor recreation and wildlife. The stresses and strains of modern urban living have pressed in with such force upon people everywhere that the need for the creation and conservation of areas for recreation is

427-943 O - 71 - 3

considered one of the most important facets of a nationwide program to improve the quality of life for more than 200 million people.

Seventy-five percent of the U.S. population is located in urban areas but only 25 percent of the public recreation facilities are located there.

In spite of this, recreation use on public lands increased by 3,000 percent from 9.3 million visitor days in 1964 to 39 million in 1969 and is expected to reach 60 million visitor days by 1976. Between 1965 and 1969, the demand for recreational facilities, particularly for picnicking and camping, increased 35 percent nationally but over 200 percent on public lands.

Wild animals add to the value and enjoyment of the total outdoor recreation experience.

The conversion of prime wildlife habitats to other land uses and the degradation of environmental quality are causing a steady decline in available public opportunities to use and enjoy wildlife. As a corollary, the future of a number of species of wildlife is in jeopardy. These include mammals, birds, fishes, amphibians, and reptiles which have value not only in the aesthetic sense but can contribute to a better understanding of ecology and man's relationship to his environment.

Some Federal lands are expressly set aside as undisturbed wilderness areas to preserve them in their natural state for future generations. Delays in setting aside greater numbers of these areas, especially within national parks, have stirred a public controversy, particularly among conservation groups.

Natural areas have become immensely popular with the millions who visit them each year. Yet the enjoyment diminishes as the number of tourists rises. Some of the more popular natural areas in parklands have become clogged with traffic, noise, litter, smog, and other factors which visitors are trying to escape.

Attention is also being given to improving recreational opportunities on private land. More than a thousand small watershed projects are now complete or under construction. Of these, 273 projects include land and water improvements for recreation use. Many of these projects include provision for several lakes. Surrounding land and neighboring recreational facilities such as hiking trails and camping areas also are available. When all projects are completed—within 2 to 5 years—they will provide over 13 million user-days of recreation annually.

Energy Resources

In its various forms, oil supplies a fourth of industrial energy, nearly half of household and commercial heating needs, and virtually all of that employed in moving goods and people. Oil contributes some 44 percent of the total U.S. energy supply. We consume it in enormous volumes: the current rate is 15 million barrels a day.

The recent history of domestic oil supply is one of gradual transition from abundance to scarcity. Until 1948, the United States was a net exporter of oil. Since then, we have imported oil under a program which limited the volume of certain oils that could enter our markets. Since 1967, however, the field of choice in the matter of imports has dramatically narrowed. Today, our domestic industry cannot produce our full requirements.

Growth in our dependence on foreign oil sources is related directly to the use of residual fuel oil, which is used mainly by powerplants and factories and for heating large buildings. For years, residual was the unwanted by-product of refining operations in the United States and was sold at prices well below the cost of the crude oil from which it was made. Consequently, refiners cut back the production of residual oil as rapidly as they could to provide more yield in the higher valued products. As a result, a steadily increasing portion of the market had to be satisfied by imported residual fuel.

Now the patterns of both supply and demand for residual are changing. Primarily because of air-quality standards imposed by large metropolitan areas, which require low-sulfur fuels, the demand for residual fuel oil with a low-sulfur content is expanding even more rapidly. This phenomenon is not confined to the United States; it is worldwide.

The outlook is for domestic production to peak in the next few years at about 13 million barrels a day, counting natural gas liquids, after which it will begin a slow decline. To the extent that production from the North Slope of Alaska is developed and brought to market, the drift toward steadily greater reliance upon imports can be mitigated.

It could also be mitigated by the amount of oil that could be supplied from development of large oil shale reserves in the Western United States and from conversion of coal to oil.

Natural gas is at once the most attractively convenient and scarce fuel resource. As with oil, our reserves of gas are diminishing. However, over the past two decades, gas demand has grown strongly, at an average annual rate of about 6 percent. This was half

again as fast as total energy consumption grew, which meant that gas displaced other fuels in the market.

This long period of differential growth is now at an end, and the outlook is for gas to lose market position steadily over the coming years. It is not realistic to suppose that gas supply can expand at even the 3.4 percent annual rate projected for energy as a whole over the coming 15 years.

Meanwhile, gas demand continues to rise by roughly 1 trillion cubic feet a year—somewhat more than that over the past 2 or 3 years. This means that, once the effective delivery capacity of domestic gas fields has been reached—and this may be by next year—we shall have to find additional energy sources—foreign or domestic; gaseous, liquid, or solid—to the equivalent of at least 1 trillion cubic feet of gas each year.

In 1969, nuclear-generated electric power supplied two-tenths of 1 percent of the energy consumed by the United States. Between now and 1980, the nuclear contribution will expand enormously in terms of its present small base. It is estimated that, by the end of the current decade, nuclear-generating capacity will probably reach 148 million kilowatts, providing some 900 billion kilowatt-hours of electricity. This translates into 10 percent of the Nation's anticipated energy supply in 1980. The share of energy provided by nuclear power will therefore be relatively modest until after 1980. To the extent that nuclear powerplants displace those fired by oil and gas, the result is a net gain in the share of energy available from domestic sources. But the displacement of coal by nuclear power makes no contribution at all in this respect, since coal is our most abundant energy resource.

In contrast to coal, the amount of known uranium reserves mineable at competitive costs is limited. While new reserves are certain to be added in response to the great expansion in exploratory activity over the past few years, the demands of projected nuclear plants will continue to press hard against supply until the breeder reactor is an accomplished reality. This is not expected at any time before the 1980's.

Depending upon such criteria as depth of deposit and thickness of seam, the United States has hundreds of years' supply of coal in discovered, measured, recoverable reserves. Authoritative estimates agree that our coal resources are ample for as far into the future as we can reasonably foresee.

In 1910, coal supplied over three-fourths of our energy. Subsequently, coal was displaced, first by oil, then by gas, until currently it provides barely one-fifth of our total energy supply. Today, coal supplies less than 4 percent of the energy used for

household and commercial heating, virtually none of the transportation market, and about 26 percent of power and process heat for industry. Only the electric power generation market remains as the major user of coal, accounting in 1969 for 60 percent of all coal consumption.

Now coal is beset by two powerful inhibitors to its projected growth: the advent of nuclear power and air-quality standards which have effectively barred large volumes of high-sulfur coal from the market. The impact from nuclear competition has been rather slight, as nuclear plants accounted for less than 1 percent of electricity production in 1970. But the situation is likely to change because a steadily growing number of metropolitan areas are imposing strict sulfur-content limitations which most eastern steam coals simply cannot meet. There is, to be sure, plenty of low-sulfur coal in the Western States, but its development will require several years, and transportation costs will in many instances be much greater.

These restrictions on sulfur content of fuels came before any of the affected industries were ready for them. In the absence of any commercially feasible means for removing sulfur from stack gases, utility plants and other consumers began to scramble for low-sulfur alternatives. This meant greater use of residual fuel oil which could be desulfurized or blended to meet prescribed standards. As a result, utility use of residual fuel oil on the east coast has doubled since 1967, while the use of coal has actually declined.

The immediate prospect, therefore, is for further erosion of coal's position in the energy mix, as air-quality standards continue to be applied by more and more states and municipalities. While much research has been done on the removal of sulfur from stack gases, this course is not yet a commercially feasible alternative to burning low-sulfur fuels. Given time and strong support from both Government and industry, it may be.

For the next few years, we shall be in a critical position with regard to the pattern our energy supply will take. Beyond that time we have a great capacity to influence the form and source of our energy supplies. There are many choices to be made and actions to be taken.

Marine Resources

Competition for the use of the limited coastal zone is intense. Shipping activities are increasing, using larger vessels which need deeper channels. Mining and oil drilling in coastal waters grows daily. Industrial and residential developments compete to fill

wetlands for building sites. Airport and highway construction follows and further affects growth patterns in the coastal zone. As a result, natural coastal areas are being nibbled away. In addition to the adverse effects caused by physical alterations of submerged and adjacent lands, pollution of estuaries and ocean dumping of wastes pose further problems. In polluted waters, vast numbers of fish and shellfish are affected as well as numerous birds, reptiles, and other wildlife which are part of this food chain. Since over 90 percent of U.S. fishery yields come from coastal waters, the dependence of the commercial fisheries industry upon a stable estuarine system is obvious.

The long-range economic and ecological costs of degraded coastal areas are borne not just by the particular local community, but by the people of the State and the region, and no less by the rest of the Nation.

On a broader geographic scale, the resources of the open oceans, which are of extremely great importance to human welfare, require improved management.

From the standpoint of biological resources in the oceans, the production of fish and shellfish probably cannot be increased to much more than about 2.5 times that produced in 1968—an eventual total of perhaps 150-160 million metric tons annually. If the estimated attainable production of food from the sea could be achieved by the year 2000, it would supply about 30 percent of the world's minimal protein requirement at that time, but only a little over 3 percent of its biological energy requirements.

The mineral and chemical resources of the sea that will be of practical interest to man over the next half century are those that can be extracted from sea water or recovered from the seabed of the Continental Shelf and oceanic rises. Marine-resource management must be consistent with all natural-resource objectives but with explicit consideration of delicate marine environmental factors. This latter point is particularly important in view of the not-yet-well-understood, but crucial, role the oceans play in the natural cycling of materials essential to human welfare.

Nonfuel Minerals

The U.S. demand for primary minerals in the nonfuel category is expected to increase an estimated 400 percent by the year 2000 if efforts are not made to reuse processed materials. Based on present trends, the Nation's self-sufficiency in primary nonfuel minerals would drop from 69 percent in 1968 to less than 30 percent by 2000. This failure of domestic production to keep pace with

demand is the result of dwindling reserves of rich domestic ores; increased exploration, mining, and processing costs; an expanding population; and increased per capita utilization. Adequate technology has not been developed to recycle used materials, to find concealed ore deposits efficiently, nor to allow economic extraction and processing of lower grade ores.

POLLUTION AND NUISANCES

The United States was blessed with what seemed, in earlier times, an unlimited abundance of land and resources. The attitude of the frontiersman, who viewed nature as an enemy to be subjugated, has remained very much a part of our view of life. Only in recent years is this frontier view giving way to a concern for husbanding resources and preserving or restoring the gifts of nature.

We have tended, moreover, to judge our progress in quantitative terms—to view growth *per se,* in any area, as an unalloyed good—and to accept as an article of faith that nothing should in any way inhibit the application of technology to produce an ever-increasing quantity of consumer goods.

Given these circumstances and these traditional attitudes, it is small wonder that an ecological view of the environment in which all elements, including man, are related and interdependent was slow in developing.

For many years, environmental pollution was tolerated as the disagreeable but acceptable price of progress. Air and water, since they belonged to all, were regarded as free resources, and there were few who questioned the right of industry, communities, or individuals to use them as sewers. Indeed, so limitless did these resources seem that their capacity for absorbing or dissipating the wastes discharged into them was taken for granted.

Only when confronted, in recent years, by gross pollution and threats of irreversible environmental damage have we begun to accept fully the fact that the wastes heedlessly generated by a growing, urbanized, high-production, high-consumption society exceed nature's capacity for self-renewal.

Today, most of our citizens are cognizant of the hazards posed by pollution. They are aware that human health, already affected by environmental stresses, can be seriously endangered by the unrestricted buildup of pollutants. They recognize that scenic beauty contributes importantly to their life, and that these values must not, and need not be, recklessly sacrificed to material progress. It has become clear, moreover, that, even in the narrowest

of cost accounting terms, pollution is costing the United States billions of dollars every year.

A new ethic has emerged which repudiates the mistakes of the past and demands the restoration and preservation of a safe, wholesome, aesthetically satisfying environment.

Air Pollution

In the 19th century, when the United States was a developing nation, and throughout the first half of this century, air pollution was regarded fundamentally as a local nuisance. Its adverse effects were considered a necessary accompaniment to economic and industrial growth. This view, until the last decade or so, inhibited almost completely serious control efforts to abate or even seriously study the problem. Today, however, there is widespread and firm public and scientific acceptance of the fact that air pollution is far more than a mere nuisance locally, and that the direct impact, accumulation, and recycling of pollutants in various ecosystems have far-reaching global implications.

In the United States, air pollution is a problem in all large cities and in many small towns. It contributes to premature death and illness, as well as to eye and respiratory irritation. It soils and corrodes physical structures of all kinds; it adversely affects agriculture and forests, and by reducing visibility, it increases air and ground traffic hazards and diminishes the aesthetic pleasures of citizens in many sections of the country.

Each year, 200 million tons of manmade waste products are released into the air over the United States. About half of this pollution is produced as a result of our transportation system, coming chiefly from the internal-combustion engine.

In terms of weight, which is not necessarily the best indication of their importance, 42 percent of these pollutants come from transportation sources, 21 percent from fuel combustion in stationary sources, 14 percent from industrial processes, 5 percent from solid-waste disposal practices, and 18 percent from forest fires and other miscellaneous sources. The main classes of primary pollutants include sulfur oxides, particulates, carbon monoxide, hydrocarbons, and oxides of nitrogen. Numerous other noxious gases and harmful particulates also are introduced into the atmosphere from a variety of specific activities. Photochemical oxidants, a category of secondary pollutants of extreme importance, are formed in the atmosphere when, under the influence of sunlight, nitrogen oxides combine with gaseous hydrocarbons.

It is well documented that episodic levels of gross particulates and sulfurous gases have caused death and illness, particularly

among infants, the elderly, and people with cardio-respiratory diseases. It is also clear that air pollution in urban areas contributes to the incidence of such chronic diseases as lung cancer, emphysema, bronchitis, and asthma. In the United States these diseases have increased dramatically in recent decades. There is a broad range of opinion as to the degree to which air pollution contributes to their incidence.

The delay in fully documenting the extent to which air pollution presents a hazard to health derives from the same complex cultural and historical factors which account for the fact that only now is the world awakening to the health and environmental hazards caused by the chemical and radiological substances produced by modern technology. Scientists are just beginning to give attention to such matters as the capacity of chemical agents in the atmosphere to produce mutagenic effects in biological systems, the metabolism of absorbed pollutants, the ways in which pollutants may alter the normal biochemistry of cells, affect the hormonal system, and alter the general functions of body activity.

Attention to the toxicologic significance of the thousands of chemicals that technology brings into our lives is increasing under the stimulus of Federal air pollution legislation developed in 1967 and extended and refined in 1970. This legislation, reflecting the growing sophistication of scientists, legislators, and the public with regard to environmental threats to health is forcing attention not only on such common pollutants as carbon monoxide, oxides of sulfur, and gross particulates, but also on lead, asbestos, beryllium, cadmium, and nickel, to mention a few of the hazardous substances found in urban atmospheres.

The adverse economic effects of air pollution are much more varied and substantial than is generally realized. They range from the waste of fuel and other valuable resources, through the soiling and corrosion of physical structures of all kinds, to damage to agriculture and forests. Moreover, by reducing visibility, air pollution contributes to the toll of accidents in both air and ground travel. Efforts to assess the total economic costs of uncontrolled air pollution have been inadequate and incomplete. They are believed to range between $10 and $15 billion annually in the United States. A systems analysis study conducted by the Government in 1970 indicated that damage to materials alone (structural materials, such as steel and concrete, rubber and leather products, fabrics and so on) costs the country $4 billion annually.

The total investment necessary through 1975 to control the major industrial and municipal sources of particulate matter, sulfur oxides, hydrocarbons, and carbon monoxide in 100 metropolitan areas of the United States has been estimated at $2.6 billion. This

includes costs for controlling both existing and new sources. By 1975, it will cost another $1.9 billion for operation, maintenance, depreciation, and interest.

These estimated costs are based on assumed future control requirements. Still, the yearly cost to control the industrial sources of these four major pollutants is relatively low, less than 1 percent of the value of the annual output of the industries involved, although the costs to some industries are much greater.

While the health effects of air pollution are no doubt of central importance in the movement toward control of the problem, it is also significant that public tolerance of the soiling, the odors, the reduced visibility, and other economic and aesthetic aspects of the problem has altered drastically in recent years. The American public has made it abundantly clear that they no longer regard air pollution as a fair price to pay for progress.

Water

Since the beginning of the 19th century, a steadily expanding population and economic growth in the United States has placed unprecedented demands on our fresh water supplies. Consumption has increased enormously, while quality has steadily declined.

Today, every river in the Nation shows in greater or lesser degree the carelessness and negligence to which each has been subjected. The most polluted are: the Ohio, the Houston Ship Channel, the Cuyahoga, the Rouge, the Buffalo, the Passaic, the Arthur Kill, the Merrimack, the Androscoggin, and the Escambia. Even the ground water is subject to pollution from the millions of gallons of waste liquids, mostly from industries.

The pollutants that clog the Nation's waters consist of an almost infinite variety of combinations—metals, minerals, chemicals, and organic matter—fed into the waters from both natural and manmade sources. Each year, more than 1,000 communities outgrow their treatment systems, and more than 1,300 communities still discharge their wastes into the waterways without any treatment whatsoever. An equal number employ only primary treatment that removes from 30 to 40 percent of the pollutants. Waste production from municipal systems is expected to increase by nearly four times over the next 50 years.

The more than 300,000 water-using industrial plants in the United States generate the most toxic pollutants. Wastes from this source are growing several times as fast as that of sanitary sewage, because of the growing per capita output of goods, declining raw materials concentrations, and increasing degrees of product process-

ing. Over half the volume of industrial waste discharge comes from four major groups of industries–paper manufacturing, petroleum refining, organic chemicals manufacturing and blast furnaces, and basic steel production.

The northeastern states have the largest amount of untreated municipal and industrial waste discharges and the largest backlog of waste treatment facility needs. Discharge of large volumes of wastes from municipal and industrial sources has greatly accelerated the natural aging process of the Great Lakes. The most seriously affected of the Lakes, Lake Erie, is now in a state of advanced eutrophication or aging. Although Lake Erie is not "dead," as some experts have asserted, it would require a massive effort to restore the productive fish population of the lake and to make the beaches safe for recreational purposes.

A number of other sources of pollution are contributing in lesser degree to the abuse of the waters: animal wastes from feedlots and runoff from irrigated and fertilized fields and areas where pesticides are used, particularly in the Midwest and the South. The Colorado River becomes more saline every year as a result of return flows of salts leached from irrigated fields.

Acid and sediment drainage from abandoned mines has destroyed life in many streams in Appalachia and the Ohio River Basin. In Appalachia alone, where an estimated 75 percent of the coal-mine-drainage problem occurs, approximately 10,500 miles of streams are reduced below desirable levels of quality by acid mine drainage.

Increased amounts of heated water are being discharged into the streams principally by the electric power industry, which requires tremendous amounts of water for cooling. Thermal pollution has presented a threat to aquatic life and encouraged the growth of harmful plant life. Many authorities believe that waste heat looms as one of the most serious types of future water pollution.

Domestic and vessel wastes from about 46,000 federally registered commercial vessels, 1,600 federally owned vessels, and 8 million recreational watercraft have polluted many coastal waters where sensitive shellfish were harvested.

Oil spills from vessels and leaks from offshore oil drilling facilities have caused spectacular oil pollution incidents in the last few years, among them the Ocean Eagle spill and the one brought on by the collision of two tankers in San Francisco Bay, the Santa Barbara offshore well leaks, and the recent fire and oil leaks from drilling in the Gulf of Mexico. Less spectacular oil spills are occurring almost daily in navigable waters across the Nation. In fiscal year 1970 alone, there were 283 spills involving about 442,000 barrels of oil.

Despite corrective legislative actions taken in recent years, the efforts to deal with the varied and complex problems of water pollution have been hampered in part by the enormous gap between the technology for producing goods and the technology for disposing of wastes created in their manufacture. The technology of water-pollution prevention and control is still in its infancy, both in terms of the relatively small amount of time and money that has so far been invested in this field and in relation to the magnitude and complexity of the task ahead.

Present technology in water-pollution control falls short in the following respects:

- Removal of oxygen-demanding contaminants from waste effluents beyond the present 90-percent efficiency;
- Renovation of effluents to produce water suitable for direct, deliberate reuse;
- Abatement of pollution from acid mine drainage;
- Control of pollution from irrigation return flows;
- Treatment and control of storm and combined sewer discharges;
- Retardation or reversal of eutrophication; and
- Prevention of ground water pollution by salt water intrusion.

A principal instrument now being developed to solve many of these problems is called "advanced waste treatment." It aims to reduce the level of pollution of the Nation's water resources by permitting repeated downstream water uses; and to renovate waste waters for direct and deliberate reuse for agricultural, industrial, recreational, and even municipal purposes.

Radiation

Throughout his history, man has been exposed to cosmic and other naturally occurring radiation. This natural background radiation still constitutes about 68 percent of the total radiation dose reaching the average U.S. citizen each year. In the United States today, however, increasing numbers of people are being exposed to a variety of low-level, manmade radiation sources, including x-rays, radioactive materials, and electronic devices in the home and workplace.

The potential benefits of successful application of nuclear and electromagnetic technology are tremendous. However, radiation as a by-product of that technology has raised serious questions, both within the scientific community and among the public, as to the magnitude and nature of the hazard to human health and the adequacy of existing radiation protection standards.

A principal focus of concern is the growing use of nuclear energy to generate electric power. Some 20 nuclear powerplants are now in operation in the United States, and about 750 are expected to be in use by the year 2000. Small amounts of radiation are released into the environment from such reactors and from fuel-reprocessing plants. Such emissions are a small fraction of limits permitted under radiation control standards. However, the fact that biological effects of low-level exposures have not been precisely quantified leaves room for disagreement over the adequacy of existing standards, which use a conservative extrapolation of measured data at high exposures. Moreover, public concern about the possibility of accidental release of large amounts of radioactivity into the environment persists, even though safety has been stressed since the very inception of the nuclear power industry to render this possibility extremely remote.

Another area of concern is the disposal of radioactive wastes from nuclear power generation and fuel reprocessing, a problem which may be expected to increase with the growth of the nuclear industry. At present, such wastes are buried or stored at carefully selected sites and a close watch is maintained to assure that leakage does not occur.

Fallout from weapons testing prior to the 1963 atmospheric nuclear test ban treaty currently contributes about 3 percent of the manmade radiation to which Americans are exposed. It is estimated that individuals who lived in the United States during the heaviest fallout in the 1950's and early 1960's will accumulate from this source a total genetic fallout dose, by the year 2000, approximately equal to that received annually from natural background radiation.

It must be borne in mind, however, that radiation generally classed as "environmental" is only a part of the total problem. Levels of radiation far higher than are present in the environment are today reaching increasing numbers of people from "nonenvironmental" sources. Medical uses of radiation, for example, now represent about 94 percent of all manmade radiation, or roughly 30 percent of all radiation sources to which the average person is exposed. Moreover, the last few years have brought increasing application of radiation in research and industrial processing as well as a phenomenal growth in the use of radiation-generating electronic products in the home and workplace.

Health effects which may result from exposure to large doses of ionizing radiation are well known—leukemia and other types of cancer, reduction in fertility, cataracts and other eye damage,

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acceleration of the aging process, and damage to reproductive cells. There is need for greater understanding of the long-term effects from repeated exposure to all forms of radiation at low levels. One must recognize that the protracted release of even very low levels of long-lasting radioactivity from an increasing number of manmade sources has implications for human health which science has barely begun to explore.

Noise

In the United States realization is growing that man cannot tolerate indefinitely the levels and types of noise that are presently a part of a modern, industrialized nation. In urban areas, where 75 percent of the population is located, the roar of air and surface transportation, the general din and hum of construction projects, and industrial noise are nearly continuous during the daylight hours. Moreover, the overall loudness of environmental noise is doubling every 10 years; and, if allowed to continue unchecked, the cost of alleviating it in the future may be prohibitive.

The problem is most severe in industry where noise-induced hearing loss looms as a major health hazard. It is estimated that up to 16 million workers today are threatened with hearing damage. In addition, noise may be a contributing factor to industrial accidents.

Hearing loss is not the only health problem associated with noise. Evidence is growing that intense noise may also harm other organic, sensory, and physiologic functions of man, and researchers are expressing fear that these effects have been seriously underestimated.

Air conditioners, lawn mowers, and a wide variety of power equipment now in common use also contribute to the problem. In fact, noise levels in apartments and private dwellings, particularly in kitchen areas, are beginning to approach those in factories. The situation is further complicated by the lack of effective noise standards in building codes to prevent the construction of living units in which noise from the outside and from neighbors filters in.

Annoyance, however, is by far the most important product of environmental noise. Although interruptions to sleep, conversation, or recreation may not cause physiological damage, they certainly have an effect on human behavior. When environmental noise is added to air pollution, crowding, traffic congestion, and the other ills that mark our urban scene, the total effect can be overwhelming.

Solid Wastes

Until relatively recently, the United States has not been greatly concerned with environmental problems associated with handling and disposing of solid wastes. In a country comprising a transcontinental landmass, small population density, and seemingly unlimited natural resources, the most convenient disposal method—usually an open dump—seemed adequate. There appeared to be no reason to reuse wastes, since virgin materials were abundant and often cheaper than reclaimed materials.

Little attempt has been made to tie the production of consumer goods to the disposal of wastes. Disposal costs are not included in the price paid by the consumer; rather, they are borne by society in general.

However, this situation is now changing, as public appreciation of the magnitude of the economic and social costs of solid wastes is building and a concept of solid-waste management is evolving. It assumes that man can devise a system that will control the quantity and characteristics of wastes, collect those that must be removed, recycle those that can be reused, and dispose of those that have no further use.

These changes in approach to the solid-waste problem have been prompted by profound economic and social changes in the United States, particularly during the last two decades. Of special significance is the large population increase (from 76 million in 1900 to over 200 million in 1970) and the shift from rural to urban character. These factors have served to increase the waste load and favor accumulation of solid wastes in urban areas.

The growth in productivity of agriculture and industry, along with changes in certain marketing techniques such as extensive use of packaging and disposable containers, have compounded the problem.

In 1920, on a daily per capita basis, about 3 pounds of solid wastes were collected routinely; today, this figure has grown to approximately 6 pounds, and by 1980 it is estimated that 8 pounds of solid wastes will be collected for each person daily.

The total solid-waste load generated from municipal and industrial sources in the United States amounts to more than 360 million tons annually. The annual total of agricultural wastes, including animal manures and crop wastes, is estimated to be over 2 billion tons. Mineral wastes add another billion tons a year. The highly combustible, toxic or nondegradable nature of many of these wastes, in addition to the vast amounts which must be disposed of, presents a major problem in many areas.

This is particularly true in urban areas, where wastes accumulate in large quantities, and there are few land disposal sites within reasonable hauling distances.

The problem of disposal is aggravated by the widespread use of convenience materials that do not burn or decay, such as one-way glass bottles and plastic packaging.

The inadequacy of present solid-waste disposal practices is indicated by a national survey, which revealed that only 6 percent of all authorized land disposal sites meet accepted standards. Nearly half of the sites contribute to water pollution, and three-fourths, to local air pollution. The survey also indicated that about two-thirds of the Nation's municipal incinerators lack adequate air-pollution-control equipment.

In addition to contributing to environmental pollution, the mismanagement of solid wastes results in scenic blight, poses a threat to public health, adversely affects land values, creates public nuisances, and results in the loss of materials such as paper and nonrenewable natural resources such as ferrous metals and other minerals. This last point is of crucial importance in determining a new approach to solid-waste management, which includes systematic salvage and reuse of waste materials. The clear necessity for conserving materials by reuse of wastes is implied in the fact that, with less than 7 percent of the world's population, the United States consumes nearly half the world's industrial materials. Such a rate of consumption cannot continue indefinitely, as more countries industrialize and as competition for world resources increases.

Pesticides

In the United States, pesticides are used to protect (1) human health through control of vectors of human and animal disease; (2) human environment and food against pest insects, rodents, birds, weeds, and spoilage organisms; and (3) forests, crops, and livestock against pests. We treat about 80 million hectares of land and water surface, about one-tenth of our total land area, with insecticides, herbicides, fungicides, and other pesticide chemicals each year.

Pesticides have been of enormous value in improving the lot of mankind throughout the world. Nonetheless, these substances are, by their very nature, biologically active and capable of adversely affecting many kinds of living organisms. Some pesticides are acutely toxic to man but are quite short-lived. Others, relatively less toxic but more persistent, result in residues on

foods and feeds. Those with high toxicity are hazardous to animals in the area of treatment or on adjacent lands or waters to which they drift. Those with long persistence may remain in the environment, and some may accumulate at successive levels of the food chain to the point where they can have adverse effects on man and his environment.

There is abundant evidence that certain persistent pesticides are distributed widely in the environment. Large amounts leave the area of application via various routes in the atmosphere or in streams and ultimately reach the oceans. Current knowledge about the concentration and effects of these materials in the open oceans is fragmentary, but it is known that the residues may collect in living organisms and produce adverse effects. Although more information on the occurrence of pesticide residues is needed—especially since growing amounts are being used throughout the world—steps are being taken in the United States to reduce this form of pollution. Emphasis is being placed on minimizing the use of persistent pesticides, finding effective substitutes which are less harmful in the environment, and developing alternative approaches to pest control, such as the use of radiation in the so-called "sterile male technique" and biological control agents.

Existing and Proposed Actions

HUMAN SETTLEMENTS

The establishment and achievement of national goals are difficult tasks. One of the major handicaps is the inadequate or poorly understood information available upon which to frame or base goals and to determine how best these goals can be won. This process must, of course, take into account the very real existence of differing political, economic, and social interests and viewpoints in such a highly varied society as the United States. It is not surprising, therefore, that national goals and programs in the complex subject area of human settlements tend to evolve relatively slowly. The experience in the United States certainly follows this pattern.

The first major involvement of the National Government in the effort to achieve better environment in human settlements occurred almost four decades ago. This was a narrow-front assault on slums and involved essentially their razing and replacement with publicly supported housing for low-income families. In time the insufficiency of this approach became apparent. Blighted or slum residential housing was but one part of a city picture which included commerce and industry, public services and community facilities, and a transportation network. Replacement of poor housing by good housing or blighted commercial areas by new structures was not enough because changes in city processes and operations often made relocation or reconstitution necessary. Federal programs, therefore, changed to meet the new understandings. Assistance to urban areas became broader in scope. In the most recent past we have come to see an even broader concept of urban or human settlement environment.

Besides the need to redevelop and revitalize the individual existing settlements, there is a great need to consider the environment available to, and influenced by, the tens of millions of new Americans who will be added to our urban population in the next few decades. Should they continue to flock into the same already large cities? Should they be channeled into other smaller cities which offer possible superior environment? Should they be induced to take up residence in entirely new cities which could boast of having the latest technological and planning developments? Or is there a mix of alternatives which offers the maximum in environment as well as the maximum in choice? These are roughly the

possible alternatives which have been identified and from which a national goal is to be selected.

National Growth Policy

In his January 1970 state of the Union address, President Nixon posed this question: Despite our continuing increase in wealth, which will increase by 50 percent in 10 years, will the President of the United States of America in 1980 "look back on a decade in which 70 percent of our people lived in metropolitan areas choked by traffic, suffocated by smog, poisoned by water, deafened by noise, and terrorized by crime?" He spoke of the need in American cities for "priceless open spaces" and stated that "the truly significant environment for each of us is that in which we spend 80 percent of our time—in our homes, in our places of work, the streets over which we travel." He called attention to the continuing flow of in-migrants to large cities already beset with problems. In order to solve the problems of American life in its cities, great metropolitan areas, and rural villages and towns, he proposed that "the Nation develop a national growth policy."

In December 1970 Congress passed a law, subsequently approved by the President, which stated, in part, that "the Federal Government, consistent with the responsibilities of state and local government and the private sector, must assume responsibility for the development of a national urban growth policy which shall incorporate social, economic, and other appropriate factors." In an eight-point elaboration, the new law declared that the national urban growth policy should incorporate the following facets:

1. "Favor patterns of urbanization and economic development and stabilization which offer a range of alternative locations and encourage the wise and balanced use of physical and human resources in metropolitan and urban regions as well as in small urban places which have a potential for accelerated growth.
2. "Foster the continued economic strength of all parts of the United States, including central cities, suburbs, smaller communities, local neighborhoods, and rural areas.
3. "Help reverse trends of migration and physical growth which reinforce disparities among states, regions, and cities.
4. "Treat comprehensively the problems of poverty and employment (including the erosion of tax bases and the need for better community services and job opportunities) which are associated with disorderly urbanization and rural decline.

5. "Develop means to encourage good housing for all Americans without regard to race or creed.

6. "Refine the role of the Federal Government in revitalizing existing communities and encouraging planned, large-scale urban and new community development.

7. "Strengthen the capacity of general governmental institutions to contribute to balanced urban growth and stabilization.

8. "Facilitate increased coordination in the administration of Federal programs so as to encourage desirable patterns of urban growth and stabilization, the prudent use of natural resources, and the protection of the physical environment."

Urban Renewal and Redevelopment

As the immediately preceding section indicates, the United States has adopted new measures—a search for a national urban growth policy—which will provide the broadest needed perspective for the optimum development of American human settlements. There are already, however, many existing policies and programs at various subordinate levels which have been useful in improving urban conditions or in stemming the negative drift of conditions. Although in sum these urban policies and programs have proved insufficient for the task at hand, most of them will very likely be continued and be fitted into the mosaic which will slowly evolve from the new national growth policy initiative.

The Federal Government carries out several programs aimed at improving the environmental nature and the efficiency of urban areas and of small communities. Some of the programs are aimed at aiding localities in establishing appropriate plans and strategies for the problems they face. An important grant program provides funds for States and local bodies to engage in planning and feasibility studies. The grants are made to help States and local communities to do needed planning and with the recognition, too, that local resources are limited. A program of research and demonstration projects develops information and experience which are available to local communities and are also used by the Federal Government in the refinement of programs. Fellowships to college students are also made available, encouraging students to study and become proficient in urban disciplines thereby increasing manpower available for States and local communities.

Rural Development

Rural development is a strategy of growth and development of nonmetropolitan America bearing great import for metropolitan

America. The central component of this strategy is to redirect the growth of this Nation in order to improve the conditions of the urban population and at the same time to increase the rate of growth of nonmetropolitan America.

Rural America encompasses about one-third of our population. Yet those who reside there are not fully participating in our national economy.

A variety of types of assistance will be needed in implementing a national policy of rural development. The following are examples which would require consideration and resolution:

1. Parity of opportunity, employment, and income for rural United States of America.
2. Incentives to business and industry to produce the basic employment opportunities which support new growth.
3. Assistance to improve needed educational and health service, housing and other community water, sewer, and solid-waste disposal facilities as well as recreation and cultural activities.
4. Assistance to small cities and towns for the purchase of surrounding land areas for residential growth, for open spaces, for industrial parks, and for recreation uses.
5. National policies to provide for the most efficient use of land.
6. Improvement of comprehensive planning capability at the state and district level.

Action Programs

In addition to the above planning and support activities, the Federal Government carries out important action programs. The urban renewal program, aimed at improving blighted and obsolescent portions of cities, is a major program which expended more than $1 billion in fiscal year 1970. Grants for the installation or improvement of basic water and sewer facilities in the same year amounted to over $100 million. Additional large amounts were expended in support of programs to provide open space in cities, beautify urban areas, and provide neighborhood facilities. The urban mass transit support program expended more than $100 million in the improvement of public transportation in local communities.

Two major new programs deserve special mention. A new approach to community development is the "Model Cities" program. Participating communities draw up their own innovative plans for neighborhood restoration and development, receiving

special funds or grants. The program and the additional funds are aimed at improving the physical and social environment of major or significant parts of a large city or the whole of a small community. Over 150 communities, ranging in size from small, rural communities to New York City, have been designated as "Model Cities." Expenditures under the Model City program are as yet quite modest, but estimates for the 1972 fiscal year are nearly $500 million.

The second new program is designed to develop complete new communities or "new towns." The authority for a greatly expanded program, in size and concept, was provided under the December 1970 legislation previously mentioned. State and local public authorities and private corporations may plan and build satellite cities or completely separate new towns under this program and will receive major financial assistance to permit approved plans to be carried out.

Housing

Although some local community efforts to improve housing began in the early 1900's, the Federal Government's first direct housing programs began in the decade of the 1930's. A public housing program provided Federal funds for the construction of housing for low-income families, with management and operation by local authorities. A mortgage insurance program greatly reduced the risks normally incurred by mortgage lenders and played a large role in attracting funds into the housing market. To these major programs, special purpose programs for the elderly, veterans, and similar groups were added. In 1968, Congress passed new legislation setting a 10-year National Housing Program. To meet this program, 26 million new housing units are required. This number would eliminate substandard housing and overcrowding and would provide the units needed during the decade to accommodate population growth and new family formations. Of the 2,600,000 dwelling units which will have to be constructed on an annual average, 600,000 units are intended for families which cannot afford to pay the full economic costs of direct housing.

The number of substandard rural housing units was reduced from about one-third of all rural housing units in 1960 to about one-fifth of all such units in 1970.

Various new housing subsidy systems have been adopted and are being developed to stimulate the production of new housing for the poor, such as rent supplements, interest supplements on rental and cooperative housing, rehabilitated homes for low-income buyers,

low-rent public housing, financial assistance to nonprofit sponsors and modernization of public housing projects.

With a view to increasing national housing production, a new program, Operation Breakthrough, was launched in 1969. Breakthrough seeks not merely new technology, but a total breakthrough in the concepts of producing, financing, and distributing housing, with a concomitant benefit to the ultimate consumer in terms of a better product at lower cost. Under the impetus of this program, private organizations have associated themselves in configurations never before attempted—some representing advanced design skills; some, new materials or assembly concepts; others, marketing techniques and experience; still others, financing experience and access to the capital markets. This is a new dimension in housing production.

NATURAL RESOURCES

Only in the past decade has an increasingly discomfited public—assailed by the sights, sounds, and smells of a degraded environment and impatient with what is perceived to be a diminished quality of life—begun to question past policies for managing the Nation's natural resources. The public appears ready to respond at all political levels to efforts for achieving a quality environment as well as a steady improvement in the standard of living.

Water

The critical imbalance between requirements and supply of water in certain parts of the Nation necessitates immediate and long-range programs to alleviate this condition, as well as to enhance availability of quality water throughout the country. Adequate supplies of quality water at reasonable costs to meet the needs of the public, agriculture, and industry must be assured. Similarly, there must be assured a sufficient quantity and quality of water for fish, wildlife, navigation, water-based recreation, and for the maintenance and enhancement of the environment.

Water pollution must be controlled to acceptable standards, and sound conservation and coordinated management of all water-use functions to improve water-use efficiency must be encouraged.

Efforts must be directed toward reducing adverse effects of natural hydrologic extremes—floods and droughts; the full potential of nonconventional water-supply technology such as desalting, reuse, and weather modification must be developed; and the

potential electric power from Federal water projects must be developed, produced, and marketed wherever it is economically justified. Moreover, the Nation's experience and technology in water-resources research and development should be shared with other nations to enhance the benefits of national and international water resources.

National efforts have proven productive in a large number of water-resource management fields. New methods are being developed to increase efficiency in management of existing supplies by water-quality and pollution control, elimination of waste in water-delivery systems, and the recycling and recharging of depleted aquifers and the reclamation of waste water.

A decade ago a research program in precipitation management, better known as weather modification, was undertaken. During the first 7 years of the program, research was directed primarily to solving the principal technological problems. Results of the pilot project stage of the program were extremely encouraging, and it is estimated that precipitation and runoff from climatically adapted areas can be increased 15 percent or more. If future tests confirm this estimate, precipitation management could add several hundred million acre-feet annually to the Nation's overall water supplies. Furthermore, the estimated cost is exceptionally modest—less than $2 an acre-foot, or less than 1 cent per 1,000 gallons.

Another area of productive research is the desalination of salty or brackish waters. Dissolved minerals can be extracted from saline waters by a variety of processes. The objective is to develop means of extraction which are within economic reach of the prospective users. Significant progress is being made. Approximately 17 years ago, only a few small land-based plants were in existence, and the cost of fresh water produced was about $4 per 1,000 gallons. Present-day costs of operating plants in the 1-million-gallon-per-day size are less than 90 cents per 1,000 gallons. With advancing technology, including the development of fast breeder nuclear reactors as a cheap energy source and the construction of large plants producing as much as 1 billion gallons per day, estimates of desalted water before the year 2000 are as low as 10 cents per 1,000 gallons.

If such costs are realized, and it is not unreasonable to expect this of modern technology, the water supply problems of our coastal areas and economically reachable inland areas would be substantially solved. Moreover, within the continental mass there are vast underground reservoirs of brine water which could also be made available for industrial and human use through desalting.

Finally, another potential water-supply possibility is the deep-seated geothermal resource. Superheated ground water, of which

the Yellowstone geysers are a manifestation, have long been considered a source of energy, but there is no reason why they cannot also be considered a source of water as well. The energy comes roaring to the surface as superheated steam. When the energy is extracted, water can be further distilled to clarity of a normally high mineral content. Preliminary estimates show at least 2 billion acre-feet of water in the total brine resource in the Imperial Valley with a potential production of from 2 to 4 million acre-feet of good water annually, along with the generation of 20 million kilowatts of electric power.

Land

Broad national objectives have been established for managing the more than 750 million acres of public lands in order to meet future public needs. Also, both Federal and State Government programs are directed toward the improvement of millions of acres of private land for agricultural production.

Specific program goals for completion by the early 1980's will provide up-to-date topographic coverage of current urban and urbanizing areas; analysis of urban hydrologic systems and adequate collection and distribution of hydrologic data for the major centers; intermediate scale geologic mapping of the continental margins; delineation of geologically hazardous areas and determination of engineering properties of sea-floor sediments adjacent to harbors, industrial sites, and residential areas; and determination of the geologic and hydrologic factors affecting the land and water environment of the coastal margin.

By 1977, the goal is to depict the geology of the Nation's Continental Shelf to a depth of 200 meters; to depict selected small parts of the shelf with high potential resource or scientific value.

Between now and 1980, plans are set to complete geologic mapping of 40 percent of the U.S. land area at intermediate scale and 33 percent at large scale; to collect and analyze data for the cooperative investigations with medical scientists of the geochemical properties of the earth and the suspected relationships with health problems; to participate in and contribute to national and international programs of marine exploration and for solution of fundamental scientific problems through combined international efforts.

We are increasingly concerned with the necessity for preemption of prime farmland for farm use. Such land has soils highly responsive to management and is capable of continuous high yields with appropriate application of technology. Prime farmlands are favorably located with respect to water availability and manage-

ment, climate, and markets. Much of this prime farmland is near cities where there is continuing diversion of such land to urban uses.

We currently harvest crops from about 300 million acres. This base amount can continue to be sufficient for this purpose if, but only if, production capability for our many diverse crops is maintained.

As a part of the National Cooperative Soil Survey, soil maps that meet current standards for all potential users have been made on about 43 percent of total land area planned to be mapped. We know, in broad terms, the soil characteristics and productive capability of all our soils. But we need detailed information on specific soils. Such information is essential to urban planning and road construction as well as for agriculture and forestry. Our present projection is that a completion of soil mapping will be achieved on a once-over basis by the year 2000.

In the area of earth hazards, program goals include the development of criteria for predicting the behavior of earth materials during earthquakes both on land and offshore; development of better estimates of earthquake probability in different areas; by 1980, development of techniques for earthquake prediction; installation of a reconnaissance monitoring network of all cascade volcanoes to determine which are potentially active; and, finally, completion by 1985 of detailed geologic mapping of the cascade volcanoes.

The Soil and Water Conservation Needs Inventory of the Nation's 1,437 million acres of non-Federal rural land shows that 63 percent, or 902 million acres, needs conservation treatment of some kind. Land owners and users in soil conservation districts have applied and are maintaining adequate treatment on nearly 516 million acres or 36 percent of the total.

During the 5-year period beginning in 1973, the United States plans an inventory and priority ranking of watersheds for treatment on 160 million acres of public land; a design for land treatment and development practices on 32 million acres; application of treatment and development practices on 20 million acres of deteriorating public lands; reduction of sediment yield by 9 million tons annually; and reduction of flood damage by 5 percent on the public lands watershed.

Living Resources

Objectives in the field of livestock forage are to maintain production or provide additional forage to sustain development of livestock operations and to assure proper management of public

lands having watershed, wildlife, or other environmental problems which are susceptible to correction through livestock management.

Our forest lands, both National Forests and those privately owned, have far greater production potential than is currently realized. Timber growth and harvest could be materially increased by stand improvement in most forest areas and reforestations of nonstocked lands.

The growing need for augmented recreational opportunities, particularly within and near urban areas, has prompted plans and actions at the national level to accelerate the pace of obtaining areas for parks and recreation use. Emphasis has been placed upon conversion of federally owned lands to the highest and best use—which in many cases can be for parks, recreation, or open space. The President has also called for transfer of surplus Federal lands to state and local governments for park and recreation use at as much as 100-percent discount in the purchase price. Also, methods will be explored for helping local governments buy unused agricultural lands and contract with private landowners for public recreation use of their lands.

The principal means of adding more outdoor recreation opportunities under a Federal program has been through use of the Land and Water Conservation Fund. The fund provides for matching Federal grants to states and their political subdivisions, acquiring and developing outdoor recreational areas and facilities, and appropriations to be used to acquire needed national recreation lands and waters. Since 1965, more than half a billion dollars has been appropriated from the fund for recreation purposes.

Emphasis upon urban recreational opportunities has resulted in programs to bring parks to people and to make existing parks more meaningful through improved and expanded services. Also stressed is a vigorous, creative program of environmental education to increase environmental awareness throughout our society.

Energy

Finally, there must be provision for the orderly development of publicly owned energy resources. Alternate routes which might be taken to augment supplies of oil, for example, include exploitation of the enormous oil shale resources in western Colorado, Utah, and Wyoming. Also noteworthy is the fact that to date less than 35 percent of the oil discovered in the United States has been produced. Each one percentile by which this recovery rate can be increased means 4 billion barrels of oil that can be reclaimed from known fields. Research could profitably be directed toward

this objective. Similarly, many trillions of cubic feet of natural gas remain locked up in the tight formations of the Rocky Mountains. Successful conclusion to tests of the capability to loosen these formations by nuclear fracturing might help narrow the gap between gas requirements and domestic supply.

An essential consideration in meeting the growing energy gap is that adequate data be developed concerning onshore and marine energy resource potentials. Needed are improved techniques and tools for locating and evaluating new energy resources. These would include regional stratigraphic analyses of broad areas, as well as detailed investigations on low-sulfur coal, natural gas, petroleum, uranium, and geothermal resources.

More efficient methods for extracting and processing fuel minerals need to be developed, while at the same time preserving environmental quality.

Development of a technology for production of pollution-free fuels is a matter of high priority.

POLLUTION AND NUISANCES

Air Pollution

Only within the last decade has there been any widespread understanding of the fact that air pollution is a complex phenomenon of global significance, which involves gaseous as well as particulate contaminants that can sometimes be altered and rendered more hazardous through interreactions in the atmosphere.

In the 1930's, forties, and fifties, smoke pollution in many U.S. cities reached levels so high that on some winter days it was difficult to distinguish noon from midnight. Even a public which had long regarded pollution as a symbol of progress and prosperity found such levels intolerable. Civic action, under the spur of public indignation, led to the strengthening of local ordinances and of abatement efforts to control smoke. In this same period fortuitous economic and technological developments were also tending to reduce coal smoke in cities. Important among these were the advent of the diesel engine to replace steam locomotives, the increasing use of petroleum and gas to produce heat and power, particularly for commercial and domestic uses, and a trend toward suburbanization which tended to spread the sources of pollution geographically. The result was a dramatic lowering of particulate levels in the atmosphere of many eastern and midwestern cities.

But continued urban, suburban, and industrial growth, sharply accelerating power and energy requirements, increasing technolog-

ical diversity and a pattern of increasing dependence on the motor vehicle brought the more serious and complex problem of air pollution which we know today.

The persistence of the historical view which equated air pollution with coal smoke, and the lowering of smoke levels in some U.S. cities, might have delayed Federal attention to air pollution for at least another decade, had it not been for the growing seriousness of smog in Los Angeles, where coal had never been a factor. Beginning in 1947, Los Angeles County mounted a pioneering control program much superior to any local control effort ever instituted. But it was soon apparent that the problem there portended a national problem which would not yield to the knowledge at hand. Primarily through the efforts of California legislators, the first identifiable Federal program on air pollution was brought into existence in 1955. The new legislation authorized the Public Health Service to conduct a modest air-pollution research program and to offer technical assistance to states and local governments, which have primary responsibility for dealing with community air-pollution problems.

Largely through the research and educational efforts of the Federal program, scientific and public attention to the problem increased sharply in the next few years. In 1963, Congress passed the Clean Air Act. This legislation was responsive to the growing public recognition of the fact that air pollution was more than a smoke abatement problem and that a national effort was needed. It authorized financial assistance to states and local governments for the initiation and improvement of control programs, Federal interstate abatement actions, the publication of criteria describing the effects of pollution, and placed special emphasis on gaseous pollutants, particularly exhaust emissions from motor vehicles, and sulfur oxides from stationary sources.

During the 4 years after passage of the Clean Air Act, state and local control programs were considerably expanded. Continued educational efforts and Federal interstate abatement actions stimulated scientific and public understanding of the far-reaching political and economic implications of pollution. Parallel with new research efforts, they helped demonstrate the need for new and improved control technology, particularly for gaseous pollutants, and helped underscore the vital necessity for control of emissions from motor vehicles.

In 1965, Amendments to the Clean Air Act gave the Federal program authority to curb motor vehicle emissions. Federal standards were first applied to 1968-model motor vehicles. They required complete control of hydrocarbons from the crankcase and partial control of hydrocarbon and carbon monoxide from the exhaust system.

Sharply accelerating public and scientific interest was given focus and direction through the third National Conference on Air Pollution held in December 1966. Immediately following the 1966 Conference, both the legislative and executive branches of Government moved to improve the legislative and budgetary foundations for air-pollution control. The result was the Air Quality Act of 1967, which called for a coordinated control effort by all levels of Government, and all segments of industry, through a comprehensive and systematic approach far more responsive to the scientific and social ramifications of the problem than had been embodied in any previous legislation.

The legislation required the designation of air-quality regions on the basis of meteorologic and urban factors and the publication of criteria documents describing the effects of pollutants accompanied by related documents on the types and costs of control techniques available to carry out source control. Armed with these data, states were required to establish ambient air-quality standards and implementation plans for regions designated.

Two hundred forty regions have been designated. Six criteria and related control-technique documents have been published. They cover particulates, sulfur dioxide, hydrocarbons, carbon monoxide, oxidants, and nitrogen oxides.

Air-quality standards for sulfur dioxide and particulates have been submitted for 46 regions, and 32 have been approved. Five regions submitted standards for carbon monoxide, hydrocarbons, and oxidants, and 17 regions submitted implementation plans for sulfur dioxide and particulates. No implementation plan had yet been approved when the new Clean Air Act Amendments of 1970 were signed into law. Even so, substantial progress was made under the Air Quality Act of 1967.

The 1970 Act continues grant assistance and research authorities of previous legislation, streamlines the designation of regions, and authorizes the promulgation of National Ambient Air-Quality Standards by the Federal Government. Moreover, two types of standards are now required: primary standards to protect the public health and secondary standards to protect the public welfare from the many other adverse effects of pollution.

The states, with the help of further increases in Federal financial and technical assistance, are to develop comprehensive plans to achieve these goals within definite time periods. The primary standards are to be met in most areas no later than mid-1975; the secondary goals are to be achieved as soon as is reasonably possible in each region. Other important and unique provisions of the 1970 Act include requirements that:

1. Federal emission standards apply to all emissions from new stationary sources and to those pollutants considered to be immediately hazardous to health from any source.
2. Federal authorities be permitted to enter private facilities for the purpose of inspecting pollution-control records or monitoring pollution-control equipment or methods.
3. Motor vehicle hydrocarbon and carbon monoxide emissions from 1975 models be governed by standards which require a reduction of 90 percent from emissions allowable under 1970-model-year standards. The 1976 models shall conform with standards requiring a 90 percent reduction of oxides of nitrogen.
4. Federal authorities register and regulate fuels and fuel additives.
5. Federal authorities establish a Low-Emission Vehicle Certification Board to insure the development of inherently low-polluting propulsion technology through Government purchase and use of such vehicles.
6. Federal authorities establish Federal standards for aircraft emissions.
7. Citizens be authorized to take civil court action against private or Government officials failing to carry out the provisions of the Act.

The task before the United States now is twofold: First, to insure that all existing air-pollution sources are controlled to the full extent that technology will permit. With regard to the control of particulate pollutants alone, such action would bring about dramatic improvements. For example, if we were to apply the best air-pollution-control systems now adequately demonstrated to be feasible for the control of smoke and other particulate pollutants, the 17.5 million tons per year from controllable sources we now withstand would be reduced to 700,000 tons—a 95 percent reduction. The second major task is to intensify the search for solutions to those aspects of the problem which are still beyond the reach of our knowledge. There is every reason to believe that real progress will be made on both these fronts in the years immediately ahead.

Water

Because an ecological awareness was late in developing in the United States, this Nation found itself suddenly confronted with the need to take vigorous steps to reverse the trend in water

degradation. The first actions taken by Congress—a National Clean Water Program launched in 1948—were quite modest, operating in its first 8 years on a temporary, trial basis. Building on this trial legislation, Congress enacted in 1956 the first permanent Federal Water Pollution Control Act, which was considered quite comprehensive for its time. Given new stature and increased funds, the program made some token gains over the next few years. However, it became apparent that stronger, more effective measures were essential.

Landmark amendments to the Federal Water Pollution Control Act were made in 1961, 1965, and 1966. The Water Quality Improvement Act, enacted into law on April 3, 1970, is the most recent legislative effort.

The Federal legislation which has been enacted over the years has structured a multiprogram approach implemented by a number of practical and powerful tools, among which are:

- —A construction grants program to help remove the backlog of needed treatment facilities.
- —The establishment of water-quality standards for all the Nation's interstate and coastal waters, including many lakes. This is the keystone of America's clean water program. It represents the first systematic nationwide strategy adopted in the United States for achieving water-quality management.
- —Comprehensive planning for river basin water and waste management.
- —Financial support for research, development, and demonstration activities involving advanced waste-treatment projects; water-purification methods; joint treatment systems for municipal and industrial wastes; and grants to industry or private persons to seek improved ways to treat industrial wastes.
- —Enforcement authority to deal with situations where there is little or no compliance with pollution-control laws. This authority has been one of the chief mechanisms for achieving an accelerated pollution-abatement program.

These major program thrusts represent the basic levers of the Federal Government's sweeping efforts to restore the Nation's waters. However, new and more complex environmental problems are constantly emerging to test the Nation's capacity to respond with appropriate measures.

Significant moves in this direction were taken recently in several major program areas. The key elements in these program changes are:

—Basin planning and regionalization of pollution-abatement projects made prerequisites to the receipt of Federal financial aid.
—Industry is required to guarantee that it will fulfill its responsibilities in joint treatment systems.
—A system of "cost recovery" will be implemented wherever some industrial wastes are to be treated by a facility constructed with Federal aid.
—More comprehensive guidelines for the design, operation, and maintenance of waste–water treatment facilities established.
—Introduction of a "technology transfer" program to accelerate the transfer of technological discoveries into viable treatment or recycling processes.
—Initiation of a voluntary inventory of industrial wastes by major water users to develop a data profile of all waste-water discharges.

As new challenges arise, they will demand new organizations and institutions, new management techniques, rapid application of new technology, and new directions for research, development, and scientific investigations.

Massive investments will be required to keep pace with the Nation's requirements for community waste-treatment facilities. Federal estimates have pointed to a need for at least $12 billion worth of investment by 1974 to correct the national waste-treatment backlog. Recent legislation proposed by the President would provide $6 billion in Federal funds over the next 3 years for this purpose to be matched by a like amount in state and local funds.

It has also been proposed that:

- An environmental financing authority be created so that every municipality has an opportunity to sell its waste-treatment plant construction bonds.
- Federal waste-treatment assistance programs give priority to encouraging the development of regional treatment systems in metropolitan areas based on comprehensive sewer, water, and land-use planning.
- Federal programs encourage localities to impose user charges based on the volume and concentration of wastes to increase equity and to work toward self-financing systems. These charges would cover not only industrial wastes for which policy already exists, but home and commercial wastes as well.
- Vigorous and effective enforcement of water-quality standards be implemented. The President has recommended a

broad range of tough, new enforcement procedures which include: extending Federal jurisdiction to intrastate and ground waters, streamlining the conference-hearing procedures, establishing specific effluent requirements, and setting fines for noncompliance.

- Increased attention be given to encouraging changes in state and local institutions dealing with water-pollution control and improving state programs.
- Professional, technical, and operator manpower be trained. Manpower needs in water-pollution control are great, and training should be accelerated with the Federal Government, states, municipalities, and industries all sharing in the costs and responsibilities.

Radiation

The hazards associated with radiation, unlike those of other environmental pollutants, were dramatically illustrated well in advance of widespread commercial application of radiation-producing technology. Strict governmental controls were imposed early, therefore, and the formal procedures and scientific bases for establishing and enforcing standards for protection against ionizing radiation have been the most comprehensive of any applied to environmental stresses. Even so, recent Federal actions have been aimed at making sure that the utmost precautions are observed.

Current standards are now being evaluated against all existing data to determine their adequacy and, hopefully, to end the controversy which persists in this regard.

Federal authorities have developed and have in partial operation an improved state-Federal-industry system for monitoring environmental radiation sources to provide improved surveillance capability as the nuclear power industry expands.

The National Environmental Policy Act of 1969 provided further safeguards by requiring environmental review of all Federal agency projects and proposals, including those of the Atomic Energy Commission.

Under the Radiation Control for Health and Safety Act of 1968, performance standards are established for electronic products capable of producing radiation emissions, such as microwave ovens, television receivers, and medical X-ray equipment.

To hold adverse effects from radiation to an absolute minimum, it is clear that research into the effects of low-level doses and into the problems arising from medical uses and consumer products

must be continued and intensified. It is clear, moreover, that careful regulation and control from all manmade sources of environmental radiation is essential.

Other needs include stronger controls for use of certain radioactive materials, strengthened radiation safety training, and more extensive state planning for radiation emergencies.

Noise

As recently as 1968, the Federal Government's total expenditures for all aspects of noise control were approximately $11 million. Of these funds, more than 90 percent was spent for research on aircraft noise. The remainder was spent on health effects, acoustics and noise control in buildings, and other projects such as the effects of noise on animals and archeological structures.

Since then, the Federal Government has begun to assert its leadership and responsibilities in several areas. In May 1969 the first Federal standards for occupational exposure to noise were issued, and 5 months later, the first of a series of noise standards regulating aircraft noise were set forth.

By 1970, Federal expenditures for noise-related programs had been increased 300 percent. However, 90 percent of these funds still was allotted to aircraft noise and sonic boom, leaving activities in noise research and control, including health effects, at a relatively minor level.

In an effort to correct this imbalance, the Clean Air Act of 1970, which became law on December 31, 1970, calls for the establishment of an Office of Noise Abatement and Control in the Environmental Protection Agency which will provide a new focus for activities in this area.

Solid Wastes

Primary responsibility for solid-waste collection, processing and disposal has traditionally rested with local levels of government and with state agencies involved in regulatory activity. The Solid Waste Disposal Act of 1965 marked the first significant interest by the Federal Government in the solid-waste field. This legislation was designed to assist state and local governments, and others involved in solid-waste management, by providing financial assistance for demonstrating new technology, by providing technical assistance through research and training, and through encouraging proper planning for state and local solid-waste management programs. The

Act took full cognizance of the important factors bearing on the solid-waste problem in the United States, including authority to perform research in the area by recycling and reuse of waste materials.

The 1965 Act has now been amended by the Resource Recovery Act of 1970, with expanded authority to:

- —Perform additional research to find improved methods of recovering and recycling natural resources, and develop new and improved methods in all phases of solid-waste management. Improve the level of training for persons in the solid-waste field; develop a comprehensive plan for a system of national disposal sites for the storage and disposal of hazardous wastes.
- —Assist states and local governments and interstate agencies in planning and development of resource recovery and solid-waste disposal systems.

To date, 50 state and interstate agencies have developed, or are in process of developing, statewide and regional plans for solid-waste management. Numerous research and demonstration projects have been initiated, and the results from successful projects are beginning to be applied nationally.

It is clear that control of the solid-waste problem must proceed along two fronts: reduction in the generation of wastes and improvement of waste management. Present and future Federal research efforts, therefore, place emphasis on methods to conserve natural resources by reduction of the amount of waste and unsalvable materials, and by recovery and utilization of potential resources in solid wastes. Use of economic incentives and disincentives are among the approaches considered to hold down waste generation, or to encourage use of materials compatible with solid-waste processing and disposal systems. Recovery of heat energy from solid-waste combustion for conversion to electrical power is included among other approaches to resources conservation.

The field of solid-waste management may have international implications from several standpoints:

1. Application of technology developed in foreign countries, with or without modification.
2. Pollution associated with poor solid-waste management practices which may cross national boundaries.
3. Pollution of the oceans from dumping solid wastes at sea.
4. Depletion of the world supply of minerals and other nonrenewable resources by failure to recycle and reuse solid wastes.

Work performed in the United States is consistent with these implications. For example, advances in foreign technology are being considered for application in the United States. Studies have been undertaken to determine the extent of ocean dumping, including the volume and types of waste material disposed at sea. The immediate and potential hazards associated with ocean disposal are also under study.

As specifically directed by the Solid Waste Disposal Act, the results of research and demonstration projects, and information concerning other Federal solid-waste activities, are available to any governmental entity, corporation, or individual having interest in such information. Significant findings and progress reports are made available by publication in scientific and technical journals, and in government publications. It is to be expected that access to information on solid-waste research in the United States will facilitate worldwide application of beneficial developments.

Pesticides

Federal regulations which require the registration of pesticides before they can be moved in interstate commerce are the principal means of controlling the harmful effects of pesticide usage in the United States. Registration consists of a determination that the compound, as formulated, will control the pest under the conditions of use prescribed and that the conditions of use will be safe for the applicator and for man and beneficial plants and animals. If the use will result in a residue on a food product, then a residue tolerance must be obtained. This tolerance must be sufficiently low to be deemed safe for human consumption and must not be higher than the amount required to obtain effective control of the particular pest involved.

Regulation of the use of pesticides at the point of their application is the responsibility of state and local authorities. Our states vary substantially in the degree of restriction which they impose on pesticide use. Generally, they require Federal registration or its equivalent. Some of them have greatly restricted the use of some persistent pesticides, e.g., DDT.

Research on the acute and chronic effects of pesticides on humans and other living organisms receives considerable attention. Monitoring of air, water, soil, fish and wildlife, and humans is done on a nationwide scale. The Environmental Protection Agency has been assigned responsibility to unify the regulatory functions involving pesticides.

Much remains to be done before the undeniable benefits from chemical pest control agents can be fully realized with no questions arising about safety and hazard to the public and to public values. New controls are being considered which would identify the hazards associated with the use of various classes of chemicals and would include regulatory procedures commensurate with the hazards of each group. Programs for educating pesticide users both in safe methods of handling and in proper methods of container disposal are receiving major attention.

Desirable Actions at the International Level

The existing and proposed U.S. actions sketched in the previous sections indicate the breadth of our approach to the task of controlling pollution and improving the environment in which our people will live in the decades ahead. We are aware of the fact that other nations face similar environmental problems, that they too have initiated environmental programs for similar purposes, and that many international organizations have taken steps toward coping with environmental problems that transcend the boundaries of sovereign states. While much can and must be done by nations for the interests of other countries, the U.S. Government believes the time has come for much greater cooperation among the nations of the world on problems of international concern. We need to face environmental issues together and to reinforce our respective national efforts by commitment to the protection and improvement of the environment shared by all mankind.

The United Nations Conference on the Human Environment provides an appropriate forum at which recommendations for initiating cooperative and joint actions can be adopted, including programs that could be most effectively executed through existing intergovernmental organizations and programs that may require new institutional arrangements. Collectively, these planned actions would constitute an internationally agreed program to be undertaken in the post-Stockholm period and would provide the basis for establishing priorities and for allocating resources to environmental tasks of common concern.

The topics listed below represent matters of concern that the U.S. Government believes are of sufficient importance to merit international attention. The topics are not listed in priority order; instead, they are grouped into three categories.

Category A includes four actions which are essentially concerned with the acquisition and dissemination of knowledge about the environment. These actions would help nations to cope with their environmental problems and should facilitate agreement on preventive or remedial measures.

Category B includes four actions that go beyond international cooperation in research, exchange of information, and the dissemination of knowledge. They consist of formulating policies for actually preventing or correcting environmental deterioration,

whether the operational programs would be carried out by national governments or by international organizations.

Category C includes two actions specifically designed to focus attention on the prerequisites for significant progress in solving environmental problems, viz, trained manpower, adequate funds, and effective institutions. We believe these prerequisites need to be examined in a comprehensive way.

A. ACQUISITION AND DISSEMINATION OF KNOWLEDGE

1. *Establishment of a system for exchanging environmental information*–This would involve the collection, storage, and dissemination of information on the environmental activities, programs, and experience of national governments and international organizations. Although coverage could be initially limited, the system should be designed to provide information to governments pertaining to human settlements, management of natural resources, and a wide range of pollutants and environmental nuisances regardless of their physical character or the media in which they occur. The information obtained would be the basis for strengthened national and regional economic-development programs, through the inclusion of such broad environmental considerations as health and sanitation, housing, land use, transportation, industrial planning, population distribution, aesthetics and culture, resource management, and statutory and legal mechanisms. The essential decisions that need to be made at the Stockholm conference are twofold:

a. What the dimensions of such a system would be;
b. How efforts to develop it should begin—i.e., at a regional or international level, or both.

2. *Establishment of systems for monitoring the world environment*–A variety of monitoring and surveillance systems will be required to collect and collate data on certain aspects of the environment which affect human welfare. A number of monitoring and surveillance systems currently exist which are oriented toward detecting pollutants in particular media (e.g., the atmosphere, oceans, rivers, etc.). There is a need for considering what efforts are necessary to assure that the nations of the world are adequately apprised of the current status and likely trends of factors that contribute to the deterioration of the environment. In addition to measuring pollutants, global monitoring and surveillance systems are needed to determine the status of natural resources; to identify long-term climatic change; to provide early warning for natural

disasters, such as typhoons; and to relate the health of man and other living organisms to environmental quality. The establishment of an adequate monitoring system should provide for integrating different kinds of data and for disseminating the information to all countries in an understandable form.

3. *Public education on environmental issues*–The conference itself as a public event–and particularly the major documents it will generate, i.e., the Declaration and the "State of the Environment" report—will undoubtedly have an educational impact around the world. But we must also move concretely to foster further education of our future citizens and leaders in a new environmental ethic—the duty of each of us to respect our environment for the sake of our fellow man and for posterity. Consideration could be given to such efforts as:

a. Publication of literature on pollution problems and what is being done about them;
b. Instructional materials suitable for use in various formal, public-education programs; and
c. Exhibits, visual aids, and other nonverbal modes of conveying an appreciation of environmental problems to private groups.

4. *Coordination and cooperation in research*–Research programs on known environmental problems (e.g., reduction of air pollution from burning fossil fuels, development of pesticide substitutes) could be facilitated by greater coordination among nations seeking practical solutions to their problems. We recognize that there are some disadvantages associated with the coordination of research efforts that are focused on environmental problems of essentially local or subnational scope. However, a concerted effort to identify research tasks that could be undertaken more economically by international cooperation or might be aided by pursuing alternative approaches on the part of different nations would be mutually advantageous. In any case, the coordination of national research efforts would go beyond simply exchanging information and, in some cases, might lead to joint research programs carried out by multinational teams.

As a further consideration, there are numerous environmental problems whose eventual solution requires international agreement on remedial or preventive measures but on which additional research is needed. If that research is undertaken on a cooperative or joint basis, subsequent agreement on what should be done is likely to be easier. An attempt should be made to identify relative research priorities and to devise a plan for

addressing the highest priority topics in the immediate post-conference period.

B. FORMULATION OF ENVIRONMENTAL POLICIES

1. *Limiting the degradation of the global environment*—While some specific agreements may be consummated at the Stockholm conference, in most cases the immediate objective will be to make agreed recommendations to national governments and to international organizations. Among the kinds of damage that may require global action are pollution of the oceans from various sources, the introduction into the biosphere of various bioactive chemicals, the burdening of the atmosphere with fuel-combustion products, the over-exploitation of both renewable and nonrenewable resources, and the damage to natural and historical monuments. International attention will have to be devoted to the issues surrounding these kinds of topics on a long-term basis. Insofar as there is a consensus on the need for prompt international action, the conference recommendations should include a provisional statement about the means for accomplishing desirable objectives.

2. *Environmental considerations in development programs*—This topic is specifically concerned with developing means for evaluating the environmental impact of development projects. The scope of the topic should include factors to be considered in projects financed or administered by international agencies; regional organizations both within and without the U.N. system; and national development programs. The action at the Stockholm conference would be to identify the factors involved and to recommend their consideration by national governments and international organizations.

3. *Improved management of natural resources*—This topic is threefold. It includes:

a. Measures for use by governments in managing their natural resources;
b. Planning for the utilization of natural resources on a regional basis; and
c. Evaluating alternative programs of resource development from the standpoint of their impact on the environment.

The Stockholm conference should consider not only the possibility of developing policies and plans, but also the desirability of establishing new institutional arrangements for coping with resource-management questions.

4. *Policies for improving the immediate environment of human settlements*–This topic is primarily concerned with the increasing requirements for facilities and services arising from population growth, urbanization, and changes in human settlements that tend to put greater demand upon governments to improve their countries' environments (e.g., water supplies, sewage disposal, etc.). Broadly conceived, however, it involves exchanges of experience on means to achieve national settlement objectives and to formulate policies for protecting the environs of large urbanized areas. Most nations are confronted with the prospect of their needs growing more rapidly than the available resources will permit.

C. PREREQUISITES FOR CONCERTED ACTION

1. *Increasing technical and managerial competence in environmental matters*—A more adequate supply of skilled personnel is needed to carry out environmental improvement programs in all countries. Technically advanced nations might assist the developing countries in satisfying near-term needs by making suitably trained personnel available to them. In the longer run, greater indigenous competence needs to be developed through training programs. An action plan for both aspects of this problem could be prepared for consideration by governments at the Stockholm conference.

2. *Organizational arrangements for an effective international environmental program*—New institutional arrangements may be needed for effective action on environmental problems that cut across the jurisdiction of U.N. specialized agencies. In addition, a number of interrelated organizational questions need to be discussed at the conference with a view toward making recommendations to governments. For example, how long-range programs on the international aspects of the environment should be carried out; how the existing U.N. structure may be utilized most effectively; how existing non-U.N., intergovernmental organizations and non-governmental bodies concerned with environmental affairs can contribute most effectively; and how coordination can be achieved. This is a difficult topic, but there is real danger in pursuing a piecemeal approach to environmental problems that affect the interests of all nations. More important, the U.N. conference in 1972 provides an opportunity to come to grips with this problem before a comprehensive action plan is inadvertently constrained by easy decisions and by narrow vision.

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